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NATIONAL DAM INSPECTION PROGRAM. HIDDEN LAKE DAM, (NDS ID NUMBE--ETC(U)
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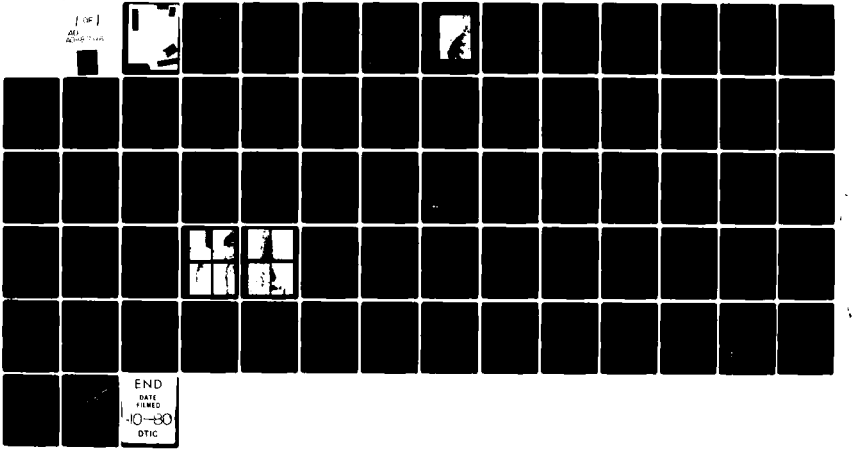

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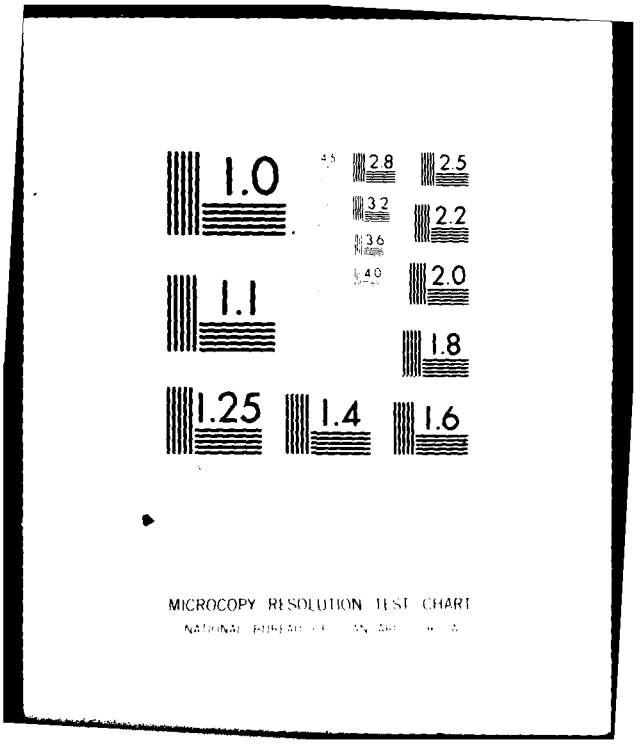
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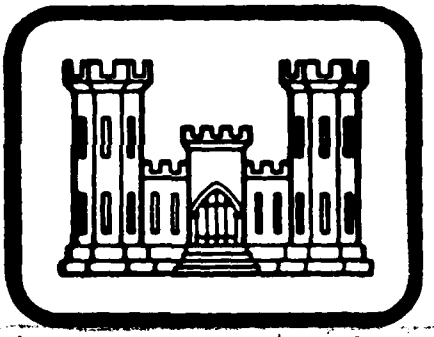
SUSQUEHANNA RIVER BASIN
HIDDEN LAKE OUTLET, LUZERNE COUNTY
PENNSYLVANIA

HIDDEN LAKE DAM

NDS ID [illegible]-PA-1136
DER ID [illegible]-40-228

SHERMAN HOOVER

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



Prepared By

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG, PENNSYLVANIA
15931

FOR

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT CORPS OF ENGINEERS
BALTIMORE, MARYLAND
21203

JULY, 1980

411 959

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in detemining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT
NATIONAL DAM INSPECTION REPORT

NAME OF DAM	Hidden Lake Dam
STATE LOCATED	Pennsylvania
COUNTY LOCATED	Luzerne
STREAM	Unnamed tributary to Shickshinny Lake
DATE OF INSPECTION	April 10, May 21, 1980

ASSESSMENT

The assessment of Hidden Lake Dam is based upon visual observations made at the time of inspection, hydraulic and hydrologic computations and past operational performance.

The Hidden Lake Dam appears to be in poor condition. A slide was noted on the downstream slope approximately 240 feet from the left abutment. The slide appeared to be inactive. A wet area was noted to the left of the discharge end of the 15" corrugated metal pipe drainline. Flow from the seepage area was determined to be less than 1 gallon per minute. The drainline for the dam consists of a 15" corrugated metal pipe with the upstream portion of the pipe blocked. No adequate facilities exist to regulate the reservoir level.

The Hidden Lake Dam is a high hazard-small size dam. The recommended spillway design flood (SDF) for this dam is the 1/2 PMF to PMF. Based on the downstream potential for loss of life, the spillway design flood has been selected as the PMF. The spillway and reservoir are capable of controlling approximately 1% of the PMF without overtopping the embankment (low spot). Based on criteria established by the Corps of Engineers, the spillway is termed seriously inadequate. If Hidden Lake Dam would fail due to overtopping, the hazard potential for loss of life and property damage immediately downstream of the dam would be significantly increased from that which would exist just prior to the overtopping. Hidden Lake Dam is classified as an unsafe non-emergency dam.

The following recommendations and remedial measures should be instituted immediately.

1. A warning system should be developed to warn downstream residents of large spillway discharges or imminent failure of the dam.

2. A detailed hydrologic and hydraulic analysis should be conducted by a registered professional engineer knowledgeable in dam design and construction to increase the spillway capacity of the dam. The recommendations resulting from the study should be immplemented immediately.

3. A detailed stability analysis should be conducted by a registered professional engineer knowledgeable in dam design and construction. An analysis should include the monitoring and evaluation of the wet area located at the toe of the dam near the outlet for the 15 inch corrugated metal pipe. The slide should be investigated and repaired as required upon completion of the stability analysis.

4. Debris collecting in the spillway and spillway approach should be cleared and continue to be cleared as required.

5. Small trees and brush existing on the downstream slope should be removed under the direction of a registered professional engineer knowledgeable in dam design and construction.

6. Re-evaluate upstream closure for the 15 inch corrugated metal pipe drainline.

7. Regular safety inspections should be conducted in accordance with provisions stipulated by the Commonwealth of Pennsylvania regarding the inspection of dams.

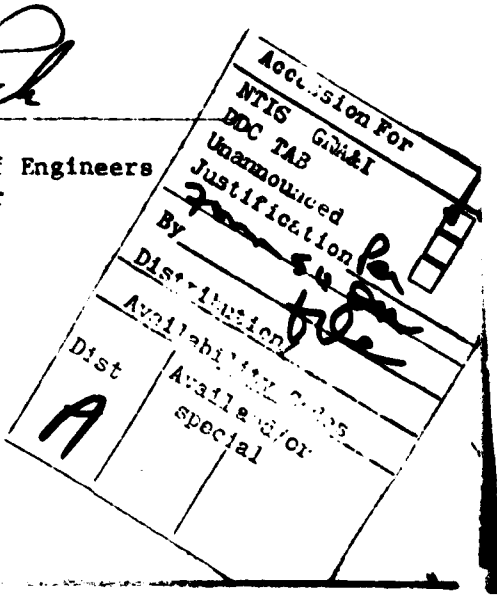
SUBMITTED BY: L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS AND ARCHITECTS

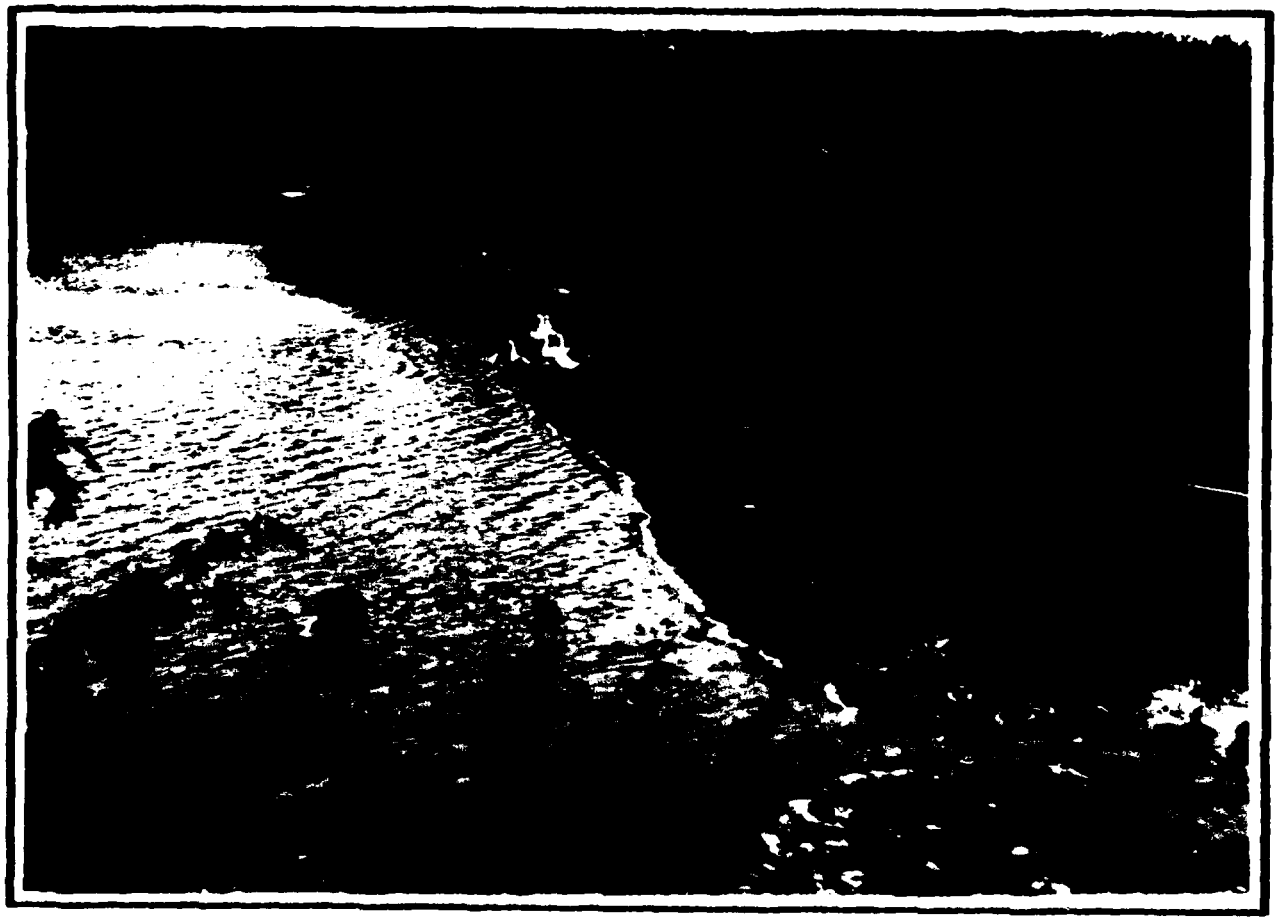
Date — R. Jeffrey Kimball, P.E.

APPROVED BY:

15 August 80
Date

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer





Overview of Hidden Lake Dam

TABLE OF CONTENTS

APPENDICES

PHASE I
NATIONAL DAM INSPECTION PROGRAM
HIDDEN LAKE DAM
NDI. I.D. NO. PA 1136
DER I.D. NO. 40-228

SECTION 1
PROJECT INFORMATION

1.1 General.

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Hidden Lake Dam is an earthfill dam, 550 feet long and 20 feet high. The crest width of the dam is 15 feet. The visible portion of the upstream slope was measured to be 1H:1V and the downstream slope was measured to be 1.5H:1V. No riprap protection was observed on the upstream slope.

The spillway is located at the right abutment and consists of an overflow section 35 feet in length. The spillway overflow section is cut into shale and flow through this section discharges beyond the toe of the dam. Flow from Hidden Lake Dam discharges to a natural stream which ultimately enters into Shickshinny Lake approximately 2000 feet downstream.

The drainline for this dam consists of a 15 inch CMP which outlets at the toe. The drainline is located approximately 220 feet from the left abutment. The drainline is not equipped with a control. The upstream end of the pipe is equipped with a section of terra-cotta pipe that is blocked with a concrete plug. The blocked section of the pipe is marked at the surface of the reservoir by a buoy which is attached by a cable to the terra-cotta pipe. The owner reported that if the need should arise to drain the lake that a weighted object could be lowered along the cable down to the terra-cotta pipe, and the pipe could be smashed by the weight thus allowing the lake to drain.

b. Location. The dam is located on unnamed tributary to Shickshinny Lake, Luzerne County, Pennsylvania. Hidden Lake Dam can be located on the Shickshinny, U.S.G.S. 7.5 minute quadrangle.

c. Size Classification. Hidden Lake Dam is a small size dam (20 feet high, 87 ac-ft).

d. Hazard Classification. Hidden Lake Dam is classified as a high hazard dam. Downstream conditions indicate that loss of more than a few lives is probable should the structure fail. One home is located approximately 1000 feet (4 people) downstream of Hidden Lake Dam. Shickshinny Lake is located approximately 1/2 miles downstream and the Borough of Shickshinny is located 4 1/2 miles downstream.

e. Ownership. Hidden Lake Dam is owned by Mr. Sherman Hoover. Correspondence should be addressed to:

Mr. Sherman Hoover
R.D. 1
Shickshinny, Pennsylvania 15865
(717) 256-3437

f. Purpose of Dam. Hidden Lake Dam was constructed for the purpose of recreation.

g. Design and Construction History. Hidden Lake Dam was built in 1967 by the Laubach Construction Company. There was no engineer retained for the design or analysis of the dam. The owner reported that during construction the approach to the upstream slope was dozed to a 3H:1V slope. The slope near the top of the dam which was observed during the inspection was somewhat steeper than that reported by the owner. No design drawings were available and construction information was supplied by the owner. The owner supplied the inspection team with a contour map which was made prior to construction of the dam. This map was utilized during the hydrologic and hydraulic analysis for this dam.

h. Normal Operating Procedures. No regularly scheduled operations are conducted at the dam. Debris which collects in the spillway is cleared on a regular basis.

1.3 Pertinent Data.

a. Drainage Area. 0.36 square miles (U.S.G.S. 7.5 minute quadrangle)

b. Discharge at Dam Site (cfs).

Maximum known flood at dam site	Unknown
Drainline capacity at normal pool	Unknown
Spillway capacity at top of dam	10 cfs

c. Elevation (U.S.G.S. Datum) (feet). - Field survey based on an estimated pool elevation of 1000 feet from U.S.G.S. 7.5 minute quadrangle.

Top of dam - low point	1000.2
Top of dam - design height	Unknown
Normal pool	1000.0
Spillway crest	1000.0
Entrance invert - 15" CMP	Unknown
Exit invert - 15" CMP	980.2
Maximum tailwater	None
Toe of dam	980.0

d. Reservoir (feet).

Length of maximum pool	1600
Length of normal pool	1500

e. Storage (acre-feet).

Normal pool	82
Top of dam	87

f. Reservoir Surface (acres).

Top of dam	16.5
Normal pool	16.5
Spillway crest	16.5

g. Dam.

Type	Earthfill
Length	550 feet
Height	20 feet
Top width	15 feet
Side slopes - upstream	1H:1V to 3H:1V
- downstream	1.5H:1V
Zoning	None
Impervious core	None
Cutoff	None
Grout curtain	None

h. Reservoir Drain.

Type	15" CMP
Length	Unknown
Closure	Concrete plug
Access	None
Regulating facilities	None

i. Spillway.

Type	Open cut
Crest length	35 feet
Crest elevation	1000.0
Upstream channel	Lake
Downstream channel	Natural stream

SECTION 2
ENGINEERING DATA

2.1 Design. No design data exists for this dam. The owner supplied a topographic map which was made prior to construction of the dam. This information was utilized in Section 5 of this report. No photographs, permits or correspondence were supplied by PennDER.

2.2 Construction. No information exists on the construction of this dam.

2.3 Operation. No operating records are maintained.

2.4 Evaluation.

a. Availability. Information utilized in the preparation of this report was supplied by the owner. The owner of the dam accompanied the inspection team on the inspection of Hidden Lake Dam.

b. Adequacy. Detailed analysis cannot be made because of a lack of detailed construction information. This Phase I Report is based on available data, visual observations, and a hydrologic and hydraulic analysis. Sufficient information exists to complete a Phase I Report.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. The onsite inspection of Hidden Lake Dam was conducted by personnel of L. Robert Kimball and Associates on April 10 and May 2, 1980. The inspection consisted of:

1. Visual inspection of the retaining structure, abutments and toe.
2. Examination of the spillway facilities, exposed portion of any outlet works and other appurtenant works.
3. Observations affecting the runoff potential of the drainage basin.
4. Evaluation of the downstream area hazard potential.

b. Dam. The dam appears to be in poor condition. From a brief survey conducted during the inspection, it was noted that a low spot exists approximately 160 feet from the left abutment. In general, the crest of the dam is slightly lower at mid-embankment and rises slightly to either abutment. Very little of the upstream slope was visible during the inspection. The portion of the upstream slope that was visible during the inspection was measured to be 1H:1V and the downstream slope 1.5H:1V and grass covered. Small trees and brush were observed to be growing on the downstream slope. A slide was observed during the inspection on the downstream slope approximately 240 feet from the left abutment. No seepage was observed in the area of the slide during the inspection. The existance of the slide indicates potential instability of the slope.

c. Appurtenant Structures. The spillway for Hidden Lake Dam is located at the right abutment. The spillway is cut into shale and discharges along the right abutment beyond the toe of the dam.

The drainline for the dam consists of a 15" corrugated metal pipe. The upstream end of the pipe is blocked with a concrete plugged terra-cotta pipe. No regulating valves exist for this pipe. The reservoir can be drained only by smashing the terra-cotta pipe blocking the upstream end of the corrugated metal pipe.

d. Reservoir Area. The watershed is covered by woodlands. The watershed slopes are moderate and do not appear to be susceptible to landslides which would affect the storage volume of the reservoir or overtopping of the dam by displacing water.

e. Downstream Channel. The downstream channel for Hidden Lake Dam consists of a natural unnamed stream which discharges into Shickshinny Lake approximately 2000 feet downstream of Hidden Lake Dam.

3.2 Evaluation. In general, the embankment appears to be in poor condition. Only the outlet for the 15" corrugated metal pipe was visible during the inspection. No other evaluation of the drainline could be made. Minor seepage was observed during the inspection.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures. The reservoir is maintained at the spillway crest elevation. The spillway and approach is cleared of debris on a regular basis. No other operational procedures are performed at the dam.

4.2 Maintenance of the Dam. No planned maintenance schedule exists. Maintenance of the dam is performed by the owner on an as-need basis. Maintenance of the dam is considered fair.

4.3 Maintenance of Operating Facilities. Maintenance of the spillway is considered fair. Debris is cleared from the spillway on a regular basis by the owner.

4.4 Warning System in Effect. There is no warning system in effect to warn downstream residents of large spillway discharges or imminent failure of the dam.

4.5 Evaluation. Maintenance of the dam is considered fair. There is no system in effect to warn downstream residents of large spillway discharges or imminent failure of the dam, and there is no formal maintenance and inspection program.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features.

a. Design Data. No calculations or design data pertaining to the hydrology or hydraulics of the dam were available.

b. Experience Data. No rainfall, runoff or reservoir level data were available. The spillway reportedly has functioned adequately in the past.

c. Visual Observations. The spillway appeared to be in fair condition. The spillway is located at the right abutment of the dam and cut into shale. Only 0.2 foot of freeboard exists for this dam.

A low spot was observed on the embankment crest 160 feet from the left abutment.

d. Overtopping Potential. Overtopping potential was investigated through the development of the probable maximum flood (PMF) for the watershed and the subsequent routing of the PMF and fractions of the PMF through the reservoir and spillway.

The Corps of Engineers, Baltimore District, has directed that the HEC-1 Dam Safety Version systemized computer program be utilized. The program was prepared by the Hydrologic Engineering Center (HEC), U.S. Army Corps of Engineers, Davis, California, July, 1978. The major methodologies or key input data for this program are discussed briefly in Appendix D.

5.2 Evaluation Assumptions. To enable us to complete the hydraulic and hydrologic analysis for this structure, it was necessary to make the following assumptions.

1. The pool elevation in the reservoir prior to the storm is the spillway crest elevation 1000.0.

2. Flow through the spillway was considered to exhibit the properties associated with the standard weir flow formula ($Q=CLH^{1.5}$).

3. The top of dam was considered the low spot elevation 1000.2.

5.3 Summary of Overtopping Analysis. Complete summary sheets for the computer output are presented in Appendix D.

Peak inflow (PMF)	1054 cfs
Spillway capacity at top of dam	10 cfs

a. Spillway Adequacy Rating. The Spillway Design Flood (SDF) is based on the hazard and size classification of the dam. The recommended spillway design flood (SDF) for this dam is the 1/2 PMF to PMF. Based on the downstream potential for loss of life and property damage, the spillway design flood has been selected as the PMF. Based on the following definition provided by the Corps of Engineers, the spillway is rated as seriously inadequate as a result of our hydrologic analysis.

> Seriously inadequate - High hazard classification dams not capable of passing 50% of the spillway design flood and where there is a significant increase in the hazard potential for loss of life due to overtopping failure.

The spillway and reservoir are capable of controlling approximately 1% of the PMF without overtopping the embankment (low spot).

5.4 Summary of Dam Breach Analysis. As the subject dam cannot satisfactorily pass 50% of the PMF (based on our analysis) it was necessary to perform the dam breach analysis and downstream routing of the flood wave. This analysis determined the degree of increased flooding due to dam failure.

A reservoir pool elevation of 1000.4 was considered as sufficient to cause failure of Hidden Lake Dam. This elevation which represents a depth of overtopping of approximately 2.4 inches was considered sufficient to cause failure because of steep downstream slope at this dam and the visibly erosive nature of the embankment material.

The flood wave was routed downstream with and without failure considerations. The downstream potential for loss of life and property damage is significantly increased by dam failure. The potential for increased flooding downstream is significant, based on our analysis. Therefore, the spillway is rated as seriously inadequate. A detailed printout of the breach analysis is included in Appendix D.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. A small slide area was located on the downstream slope approximately 240 feet from the left abutment. The downstream slope of the embankment is grass covered with some small trees and brush on the slope. There is no riprap protection on the upstream face of the embankment. Only minor seepage was observed during the inspection.

The stability of the dam is questionable because of the steep slopes and evidence of past sliding and instability. Based on the lack of information regarding the design and construction of the dam and the observed slides on the downstream slope the structural integretity of the embankment is questionable and should be thoroughly evaluated. No definite determination could be made as to whether the existing slide was active or inactive, however the slide appeared to be inactive.

b. Design and Construction Data. No stability analyses were conducted for this dam. No design drawings were available for review by the inspection team. No construction data is available.

c. Operating Records. No operating records are maintained.

d. Post Construction Changes. No post construction changes were made according to the owner.

e. Seismic Stability. The dam is located in seismic zone 1. No seismic stability analyses has been performed. Normally, it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake loading. Since the static stability of Hidden Lake Dam is questionable it's seismic stability should be assessed during the recommended stability analysis.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The dam appears to be in poor condition. The reservoir is maintained at the spillway crest elevation and very little (less than 3 inches) freeboard exists at the dam. A small slide was observed on the downstream slope. Only minor seepage was observed during the inspection.

The visual observations and hydrologic and hydraulic calculations indicate that the Hidden Lake Dam's spillway is seriously inadequate. The spillway is capable of controlling approximately 1% of the PMF without overtopping the embankment (low spot). The dam breach analysis indicates that a significant increase in the downstream potential for loss of life and property damage exist should the dam fail.

b. Adequacy of Information. Detailed analysis of the dam cannot be made because of the lack of any design or construction data. No design drawings exist for this dam. This Phase I Report is based on visual observations, and hydrologic and hydraulic calculations.

c. Urgency. The recommendations suggested below should be implemented immediately.

d. Necessity for Further Investigation. In order to accomplish some of the recommendations/remedial measures outlined below, further investigations will be required.

7.2 Recommendations/Remedial Measures.

1. A warning system should be developed to warn downstream residents of large spillway discharges or imminent failure of the dam.

2. A detailed hydrologic and hydraulic analysis should be conducted by a registered professional engineer knowledgeable in dam design and construction to increase the spillway capacity of the dam. The recommendations resulting from the study should be immplemented immediately.

3. A detailed stability analysis should be conducted by a registered professional engineer knowledgeable in dam design and construction. An analysis should include the monitoring and evaluation of the wet area located at the toe of the dam near the outlet for the 15 inch corrugated metal pipe. The slide should be investigated and repaired as required upon completion of the stability analysis.

4. Debris collecting in the spillway and spillway approach should be cleared and continue to be cleared as required.

5. Small trees and brush existing on the downstream slope should be removed under the direction of a registered professional engineer knowledgeable in dam design and construction.

6. Re-evaluate upstream closure for the 15 inch corrugated metal pipe drainline.

7. Regular safety inspections should be conducted in accordance with provisions stipulated by the Commonwealth of Pennsylvania regarding the inspection of dams.

APPENDIX A
CHECKLIST, VISUAL INSPECTION, PHASE I

CHECK LIST
VISUAL INSPECTION
PHASE I

NAME OF DAM Hidden Lake Dam COUNTY Luzerne STATE Pennsylvania ID# PA 1136

TYPE OF DAM Earthfill HAZARD CATEGORY High

DATE(s) INSPECTION April 10, 1980 & May 21,1980 WEATHER Overcast and cool TEMPERATURE 60°

POOL ELEVATION AT TIME OF INSPECTION 1000.0 Est. M.S.L. TAILWATER AT TIME OF INSPECTION None M.S.L.

INSPECTION PERSONNEL:

R. Jeffrey Kimball, P.E. - L. Robert Kimball and Associates

James T. Hockensmith - L. Robert Kimball and Associates

O.T. McConnell - L. Robert Kimball and Associates

Cameron R. Mock - L. Robert Kimball and Associates

James T. Hockensmith
RECORDER

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None noted.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	Small slide located approximately 240 feet from left abutment.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Some minor erosion on upstream slope.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Horizontal alignment appears to be good. Low spot on embankment crest observed near mid-embankment.	
RIPRAP FAILURES	No riprap protection provided at this dam.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VEGETATION	Downstream slope. Trees and small brush and sparse grass.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Appears to be good.	
ANY NOTICEABLE SEEPAGE	Wet area observed near outlet of 15" CMP. Seepage less than 1 gpm.	
STAFF GAUGE AND RECORDER	None.	
DRAINS	15" CIP with inlet blocked with a terra-cotta pipe and a concrete plug.	

CONCRETE/MASONRY DAMS - Not applicable

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE		
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS		
DRAINS		
WATER PASSAGES		
FOUNDATION		

CONCRETE/MASONRY DAMS - Not applicable

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES		
STRUCTURAL CRACKING		
VERTICAL AND HORIZONTAL ALIGNMENT		
MONOLITH JOINTS		
CONSTRUCTION JOINTS		
STAFF GAUGE OR RECORDER		

OUTLET WORKS - Not applicable

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT		
INTAKE STRUCTURE		
OUTLET STRUCTURE		
OUTLET CHANNEL		
EMERGENCY GATE		

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	None. Spillway consists of open earth cut.	
APPROACH CHANNEL	Unrestricted - lake.	
DISCHARGE CHANNEL	Unnamed tributary to Shickshinny Lake.	
BRIDGE AND PIERS	None.	

GATED SPILLWAY - None

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL		
APPROACH CHANNEL		
DISCHARGE CHANNEL		
BRIDGE AND PIERS		
GATES AND OPERATION EQUIPMENT		

DOWNSTREAM CHANNEL

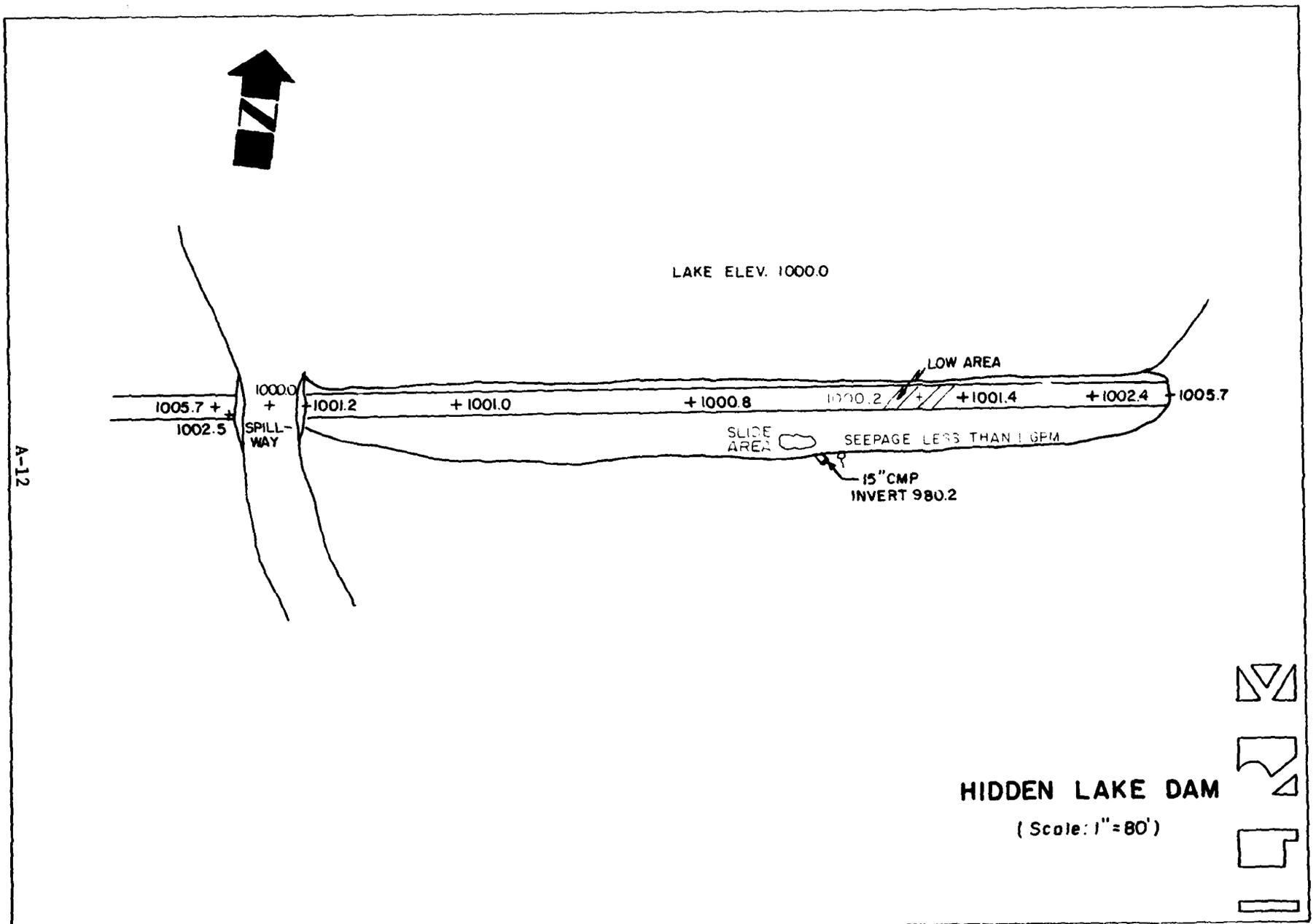
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Unobstructed unrestricted until past the toe area.	
SLOPES	Moderate to steep, appear to be stable.	
APPROXIMATE NO. OF HOMES AND POPULATION	One home located approximately 1000 feet below the dam. Four people.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Moderate, appear to be stable.	
SEDIMENTATION	Unknown.	

INSTRUMENTATION

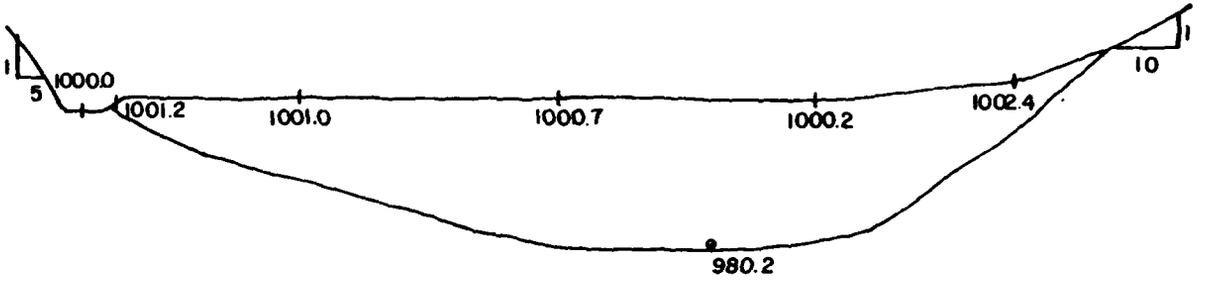
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER	None.	



HIDDEN LAKE DAM

(Scale: 1" = 80')

A-12



PROFILE
LOOKING UPSTREAM
Scale: Horiz. 1"=100'
Vert. 1"= 20'

HIDDEN LAKE DAM

APPENDIX B
CHECKLIST, ENGINEERING DATA, DESIGN, CONSTRUCTION, OPERATION, PHASE I

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Hidden Lake Dam

ID# PA 1136

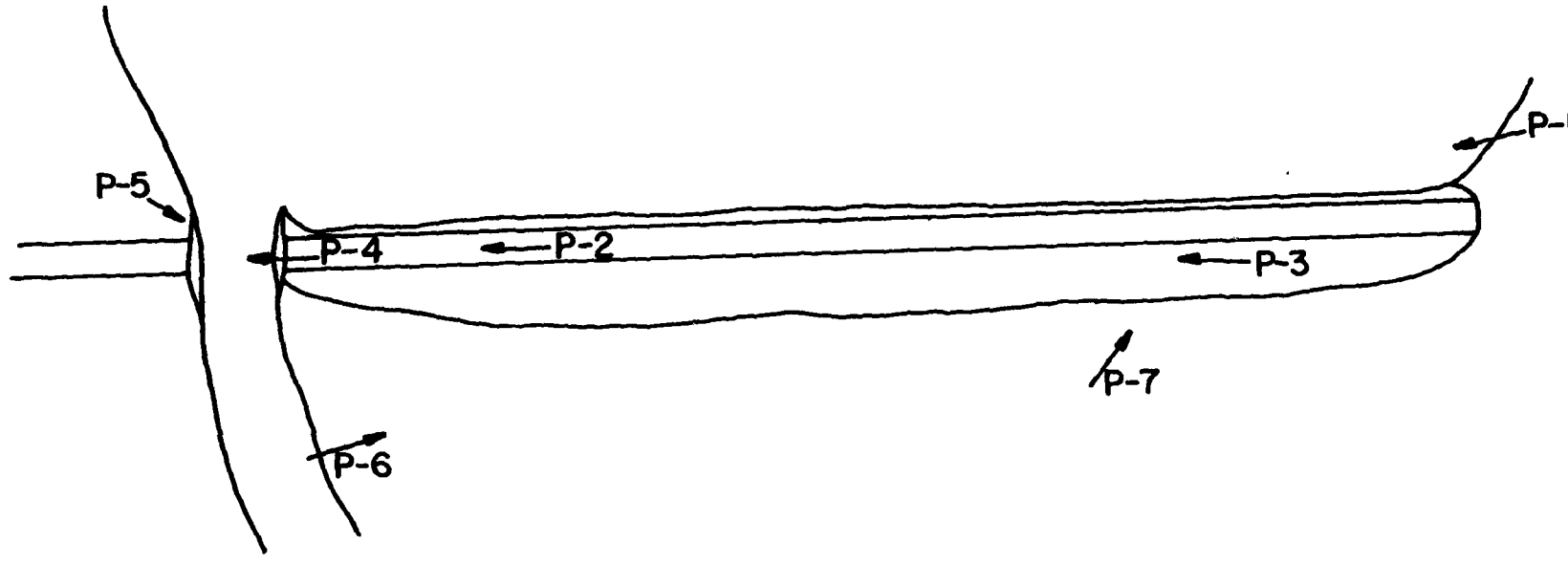
ITEM	REMARKS
AS-BUILT DRAWINGS	None.
REGIONAL VICINITY MAP	U.S.G.S. 7.5 minute quadrangle.
CONSTRUCTION HISTORY	Interview with owner.
TYPICAL SECTIONS OF DAM	None.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS RAINFALL/RESERVOIR RECORDS	None. None. None. None. None.

ITEM	REMARKS
DESIGN REPORTS	None.
GEOLOGY REPORTS	None.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None.
POST-CONSTRUCTION SURVEYS OF DAM	None.
BORROW SOURCES	Site of impoundment.

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	None.
HIGH POOL RECORDS	None.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None.
MAINTENANCE OPERATION RECORDS	None.

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	None.
OPERATING EQUIPMENT PLANS & DETAILS	None.

APPENDIX C
PHOTOGRAPHS



C-1

P-INDICATES PHOTO LOCATION

HIDDEN LAKE DAM
PHOTO INDEX

HIDDEN LAKE DAM

Photograph Description

Sheet 1. Front

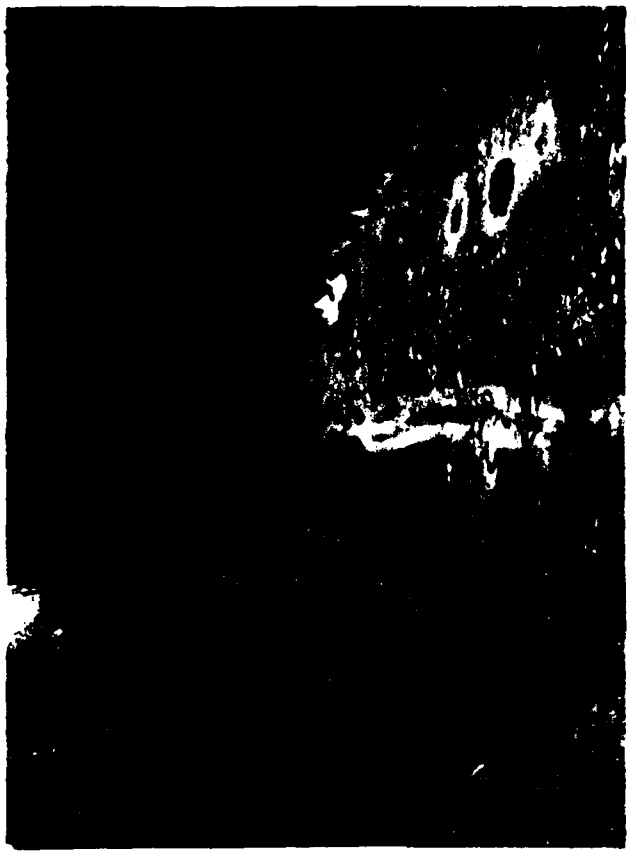
(1) Upper left - Embankment crest, upstream slope and view of right abutment.
(2) Upper right - Crest of dam, downstream slope and right abutment.
(3) Lower left - Crest and downstream slope (note vegetation).
(4) Lower right - Spillway crest.

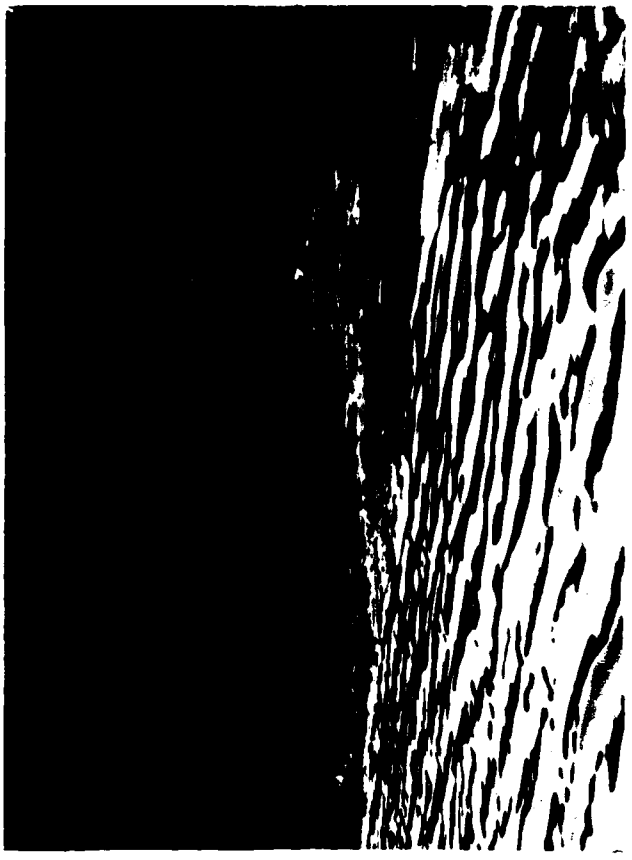
Sheet 1. Back

(5) Upper left - Spillway approach.
(6) Upper right - Downstream slope.
(7) Lower left - 15" CMP (drainline).
(8) Lower right - Downstream exposure.

TOP OF PAGE

1	2
3	4





APPENDIX D
HYDROLOGY AND HYDRAULICS

APPENDIX D
HYDROLOGY AND HYDRAULICS

Methodology. The dam overtopping and breach analyses were accomplished using the systemized computer program HEC-1 (Dam Safety Investigation), September, 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. A brief description of the methodology used in the analysis is presented below.

1. Precipitation. The Probable Maximum Precipitation (PMP) is derived and determined from regional charts prepared from past rainfall records including "Hydrometeorological Report No. 40" prepared by the U.S. Weather Bureau.

The index rainfall is reduced from 10% to 20% depending on watershed size by utilization of what is termed the HOP Brook adjustment factor. Distribution of the total rainfall is made by the computer program using distribution methods developed by the Corps.

2. Inflow Hydrograph. The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for reservoir routing.

The unit hydrograph is developed using the Snyder method. This method requires calculation of several key parameters. The following list gives these parameters their definition and how they were obtained for these analysis.

Parameter	Definition	Where Obtained
Ct	Coefficient representing variations of watershed	From Corps of Engineers*
L	Length of main stream channel miles	From U.S.G.S. 7.5 minute topgraphic
Lca	Length on main stream to centroid of watershed	From U.S.G.S. 7.5 minute topographic
Cp	Peaking coefficient	From Corps of Engineers*
A	Watershed size	From U.S.G.S. 7.5 minute topographic

*Developed by the Corps of Engineers on a regional basis for Pennsylvania.

3. Routing. Reservoir routing is accomplished by using Modified Plus routing techniques where the flood hydrograph is routed through reservoir storage. Hydraulic capacities of the outlet works, spillways and the crest of the dam are used as outlet controls in the routing.

The hydraulic capacity of the outlet works can either be calculated and input or sufficient dimensions input and the program will calculate an elevation discharge relationship.

Storage in the pool area is defined by an area - elevation relationship from which the computer calculates storage. Surface areas are either planimetered from available mapping or U.S.G.S. 7.5 minute series topographic maps or taken from reasonably accurate design data.

4. Dam Overtopping. Using given percentages of the PMF the computer program will calculate the percentage of the PMF which can be controlled by the reservoir and spillway without the dam overtopping.

5. Dam Breach and Downstream Routing. The computer program is equipped to determine the increase in downstream flooding due to failure of the dam caused by overtopping. This is accomplished by routing both the pre-failure peak flow and the peak flow through the breach (calculated by the computer with given input assumptions) at a given point in time and determining the water depth in the downstream channel. Channel cross-sections taken from U.S.G.S. 7.5 minute topographic maps were used in the downstream flood wave routing. Pre and post failure water depths are calculated at locations where cross-sections are input.

HYDROLOGY AND HYDRAULICS ANALYSIS
DATA BASE

NAME OF DAM: Hidden Lake Dam

PROBABLE MAXIMUM PRECIPITATION (PMP) = 22.2 (0.99) = 21.98"

STATION	1	2	3
Station Description	Hidden Lake		
Drainage Area (square miles)	0.36		
Cumulative Drainage Area (square miles)	0.36		
Adjustment of PMF for Drainage Area (%)(1)			
6 hours	117		
12 hours	127		
24 hours	136		
48 hours	142		
72 hours	145		
Snyder Hydrograph Parameters			
Zone (2)	13		
Cp (3)	0.5		
Ct (3)	1.85		
L (miles) (4)	0.66		
Lca (miles) (4)	0.38		
tp = Ct(LxLca) 0.3 hrs.	1.22		
Spillway Data			
Crest Length (ft)	35		
Freeboard (ft)	0.2		
Discharge Coefficient	3.2		
Exponent	1.5		

(1) Hydrometeorological Report 40 (Figure 1), U.S. Army Corps of Engineers, 1965.

(2) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's coefficients (C_p and C_t).

(3) Snyder's Coefficients.

(4) L=Length of longest water course from outlet to basin divide. L_{ca}=Length of water course from outlet to point opposite the centroid of drainage area.

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: D.A. 0.36 mi^2 wooded, moderate slopes

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 82 ac-ft

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 87 ac-ft

ELEVATION MAXIMUM DESIGN POOL: Unknown

ELEVATION TOP DAM: 1000.2

SPILLWAY CREST:

a. Elevation 1000.0
b. Type Open cut shale
c. Width 35 feet
d. Length Not applicable
e. Location Spillover Right abutment
f. Number and Type of Gates None

OUTLET WORKS:

a. Type Entrance inverts 15" CMP
b. Location Through embankment
c. Entrance inverts Unknown
d. Exit inverts 980.2
e. Emergency draindown facilities None

HYDROMETEOROLOGICAL GAUGES:

a. Type None
b. Location None
c. Records None

MAXIMUM NON-DAMAGING DISCHARGE: Unknown

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

DAM NAME HIDDEN LAKE
I.D. NUMBER DER. NO. 40-228
SHEET NO. 1 OF 4
BY GJS DATE 6/29/80

LOSS RATE AND BASE FLOW PARAMETERS

As recommended by the Baltimore District Corps of Engineers.

STRTL = 1 inch

CNSTL = 0.05 in/hr

STRTQ = 1.5 CFS/mi^2

QRCSN = 0.05 (5% of Peak flow)

RTIOR = 2.0

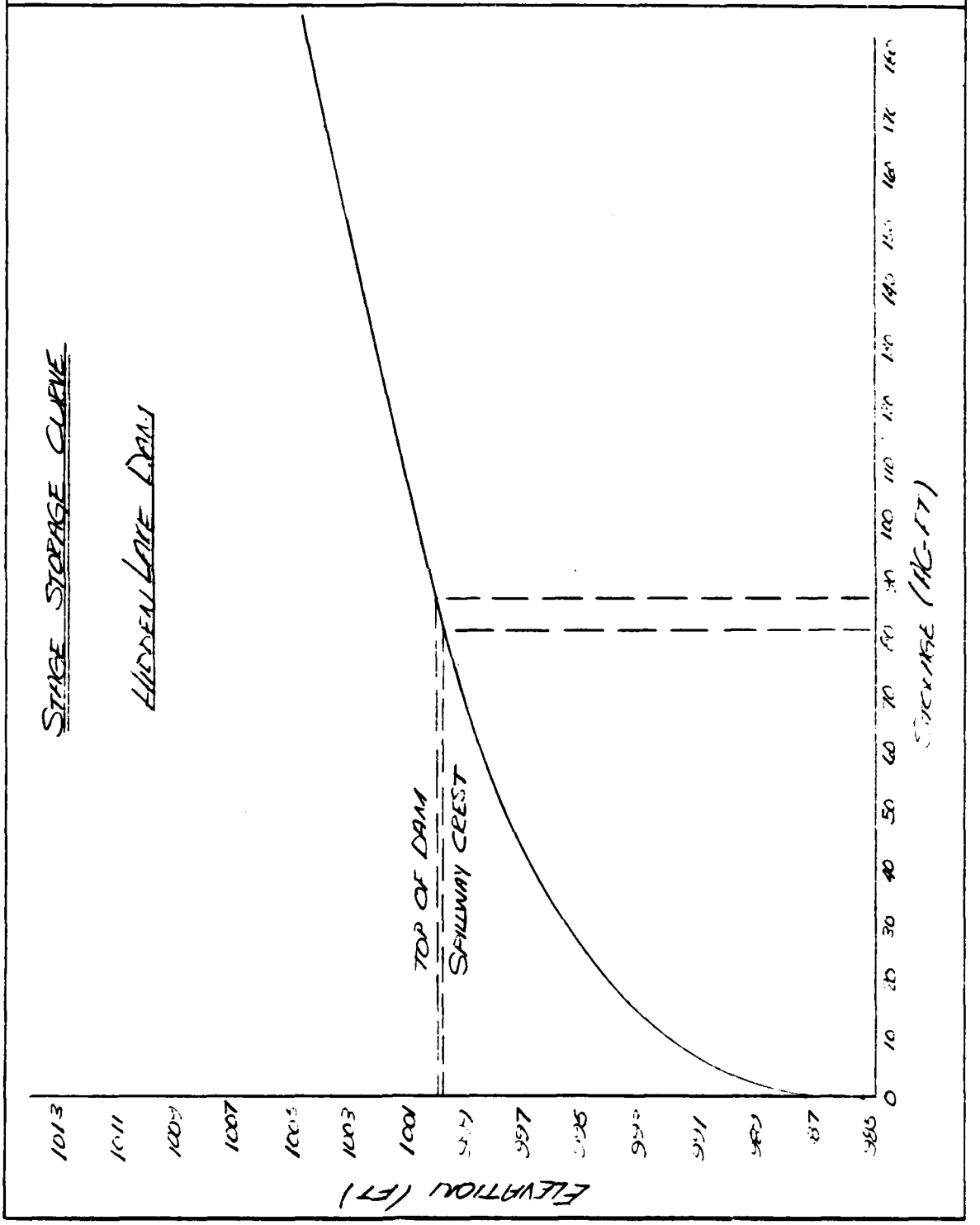
ELEVATION – CAPACITY RELATIONSHIPS

Obtained from U.S.G.S. 7.5-min Quad and field inspection data

Spillway Crest Elevation = 1000.0 FT
INITIAL Storage = 82.2 AC-FT
Top of Dam Elevation = 1000.2 FT
Storage at Elevation 1000.2 = 87.0 AC-FT
Zero Storage Elevation = 985.6 FT

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

DAM NAME HIDDEN LAKE
I.D. NUMBER DEP. ID. 40-228
SHEET NO. 2 OF 4
BY AR DATE 6/5/80



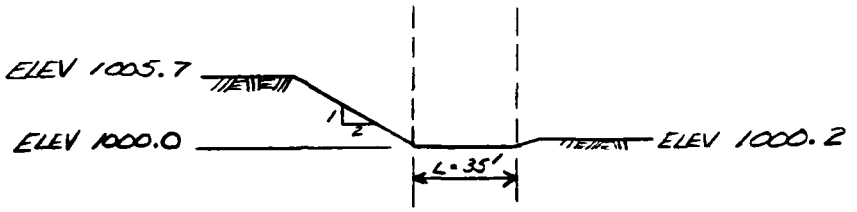
L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

DAM NAME HIDDEN LAKE
I.D. NUMBER DEP. I.D. NO. 10-228
SHEET NO. 3 OF 4
BY RP DATE 6/10/80

DISCHARGE RATING CURVE

Determined by (HEC-1).

Assume Standard Weir Flow
(N.T.S.)



Spillway Crest Elevation = 1000.0 FT
Weir Length = 35 FT
Coefficient of Discharge = 3.2

OVERTOP PARAMETERS

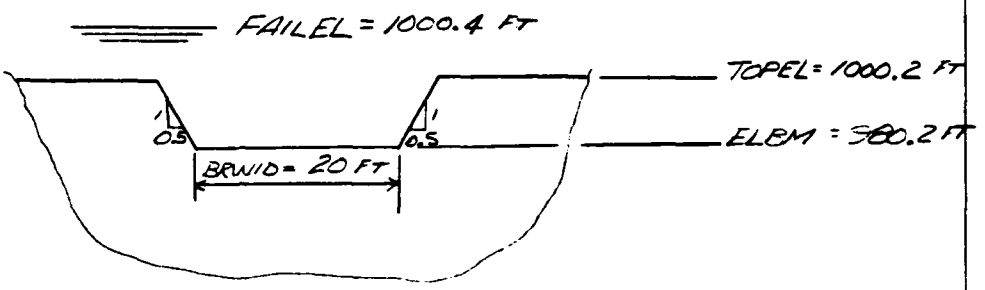
Top of Dam Elevation (Low spot) = 1000.2 FT
Length of Dam (Excluding Spillway) = 500.0 FT
Coefficient of Discharge = 3.1
$\mathcal{L}$ max = 562.0 FT
$\mathcal{V}$ max = 1005.7 FT

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

DAM NAME Hillman Lake
I.D. NUMBER DER. No. 40-228
SHEET NO. 4 OF 4
BY CJP DATE 6/12/80

DAM BREACH PARAMETERS

(N.T.S.)



Ratio of PMF (ET10) = 0.05
Side Slope of Breach (z) = 0.5
Failure Time (TFAIL) = 1 hr.
Depth of Overtop = 0.2 FT or 2.4 inches

CHANNEL ROUTING

Channel Routing cross sections obtained from U.S.G.S. 7.5-min Quad.

Channel Manning's n (QN 2) = 0.05
Overbank Manning's n (QN 1) = 0.06

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION     JULY 1978
  LAST MODIFICATION  26 FEB 79
**********
    1                 A1       ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
    2                 A2       HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF HIDDEN LAKE DAM
    3                 A3       RATIOS OF PMF ROUTED THROUGH THE RESERVOIR (PA 1136)
    4                 B   288       0      15       0       0       0       0       0       0       0
    5                 B1    5
    6                 J     1       7       1
    7                 J1  .05      .1      .2      .3      .4      .5       1
    8                 K     0       1                                       1
    9                 K1       INFLOW
   10                 H     1       1    .36                                                   1
   11                 P           21.98     117     127     136     142     145
   12                 T                                                   1.0    0.05
   13                 W  1.22    0.50
   14                 X  -1.5     -.05     2.0
   15                 K     1       2                                       1
   16                 K1       ROUTE
   17                 Y                                 1       1
   18                 Y1    1                                          -1000.0
   19                 $S    0     0.2     2.0     6.5    17.2    32.1    51.2    76.4    82.2    87.0
   20                 $S 124.0   169.0   218.0   273.0   334.0
   21                 $E 985.6   987.6   989.7   991.6   993.6   995.6   997.6   999.6  1000.0  1000.2
   22                 $E1002.0  1004.0  1006.0  1008.0  1010.0
   23                 $$1000.0    35.0     3.2     1.5
   24                 $D1000.2     3.1     1.5   500.0
   25                 $L  10.0   177.0   485.0   513.0   532.0   549.0   562.0
   26                 $V1000.2  1001.0  1002.0  1003.0  1004.0  1005.0  1005.7
   27                 K     99
```

D9

****
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79
****

RUN DATE= 80/06/12.
TIME= 07.59.20.

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF HIDDEN LAKE DAM
RATIOS OF PMF ROUTED THROUGH THE RESERVOIR

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
288	0	15	0	0	0	0	0	0	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 7 LRTIO= 1

RTIOS= .05 .10 .20 .30 .40 .50 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	.36	0.00	.36	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.98	117.00	127.00	136.00	142.00	145.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 1.22 CP= .50 NTA= 0

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 5.35 AND R= 6.49 INTERVALS

UNIT HYDROGRAPH 38 END-OF-PERIOD ORDINATES, LAG= 1.23 HOURS, CP= .50 VOL= 1.00

8.	28.	55.	81.	95.	93.	81.	70.	60.	51.
44.	38.	32.	28.	24.	20.	17.	15.	13.	11.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1000.	0

CAPACITY=	0.	0.	2.	7.	17.	32.	51.	76.	82.	87.
	124.	169.	218.	273.	334.					

ELEVATION=	986.	988.	990.	992.	994.	996.	998.	1000.	1000.	1000.
	1002.	1004.	1006.	1008.	1010.					

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1000.0	35.0	3.2	1.5	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1000.2	3.1	1.5	500.

CREST LENGTH AT OR BELOW ELEVATION	10.	177.	485.	513.	532.	549.	562.
	1000.2	1001.0	1002.0	1003.0	1004.0	1005.0	1005.7

5/1

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .05	RATIO 2 .10	RATIO 3 .20	RATIO 4 .30	RATIO 5 .40	RATIO 6 .50	RATIO 7 1.00
HYDROGRAPH AT	1	.36	1	53.	105.	211.	316.	421.	527.	1054.
		(.93)	(	1.49)(	2.98)(	5.97)(	8.95)(	11.93)(	14.92)(	29.84)(
ROUTED TO	2	.36	1	36.	86.	192.	298.	406.	512.	1045.
		(.93)	(	1.02)(	2.45)(	5.44)(	8.44)(	11.49)(	14.50)(	29.58)(

D-13

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ..... INITIAL VALUE / SPILLWAY CREST / TOP OF DAM

ELEVATION	1000.00	1000.00	1000.20
STORAGE	82.	82.	87.
OUTFLOW	0.	0.	10.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.05	1000.40	.20	91.	36.	8.00	42.50	0.00
.10	1000.61	.41	95.	86.	11.00	42.00	0.00
.20	1000.86	.66	101.	192.	14.25	41.50	0.00
.30	1001.04	.84	104.	298.	16.75	41.25	0.00
.40	1001.18	.98	107.	406.	19.25	41.25	0.00
.50	1001.29	1.09	109.	512.	21.00	41.25	0.00
1.00	1001.70	1.50	118.	1045.	25.25	41.00	0.00

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION    JULY 1978
  LAST MODIFICATION  26 FEB 79
**********
     1  A1       RATIOS OF PMF ROUTED THROUGH THE RESERVOIR AND DOWNSTREAM
     2  A2       DOWNSTREAM CONDITION DUE TO OVERTOP (HIDDEN LAKE DAM - DER 40-228
     3  A3       PLAN 1 ASSUMES BREACH. PLAN 2 ASSUMES NO BREACH.
     4  B    288                  18                                          0
     5  B1     5
     6  J      2        1        1
     7  J1  0.05
     8  K      0        1                                             1
     9  K1       INFLOW
    10  M      1        1      .86                                             1
    11  P               21.98    117      127      136      142      145
    12  T                                                          1.0    0.05
    13  W   1.22     0.90
    14  X   -1.5     -.05      2.0
    15  K      1        2                                             1
    16  K1       ROUTE
    17  Y                                          1        1
    18  Y1     1                                                   -1000.0
    19  SS     0      0.2      2.0      6.5     17.2     32.1     51.2     76.4     82.2     87.0
    20  SS 124.0    159.0    218.0    273.0    334.0
    21  SE 985.6    987.6    989.7    991.6    993.6    995.6    997.6    999.6   1000.0   1000.2
    22  SE1002.0   1004.0   1006.0   1008.0   1010.0
    23  SS1000.0     35.0      3.2      1.5
    24  SD1000.2      3.1      1.5    500.0
    25  SL  10.0    177.0    485.0    513.0    532.0    549.0    562.0
    26  SV1000.2   1001.0   1002.0   1003.0   1004.0   1005.0   1005.7
    27  SB     20      0.5    980.2        1     1000   1000.4
    28  SB     20      0.8    980.2        1     1000   1002.0
    29  K      1        3                                             1
    30  K1       CHANNEL ROUTING
    31  Y                                          1        1
    32  Y1     1
    33  Y6  0.06     0.05     0.06      938      960     1450    0.028
    34  Y7     0      960       50      950      100      940      102      938      107      938
    35  Y7   109      940      150      950      200      960
    36  K     99
```

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION  JULY 1978
  LAST MODIFICATION  26 FEB 79
**********

RUN  DATE= 80/06/16.
     TIME= 05.31.42.
```

RATIOS OF PMF ROUTED THROUGH THE RESERVOIR AND DOWNSTREAM
DOWNSTREAM CONDITION DUE TO OVERTOP (HIDDEN LAKE DAM - DER 40-228
PLAN 1 ASSUMES BREACH. PLAN 2 ASSUMES NO BREACH.

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
288	0	15	0	0	0	0	0	0	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 2 NRTIO= 1 LRTIO= 1

RTIOS= .05

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	.36	0.00	.36	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.98	117.00	127.00	136.00	142.00	145.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 1.22 CP= .50 NTA= 0

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 5.35 AND R= 6.49 INTERVALS

UNIT HYDROGRAPH 38 END-OF-PERIOD ORDINATES. LAG= 1.23 HOURS. CP= .50 VOL= 1.00

8.	28.	55.	81.	95.	93.	81.	70.	60.	51.
44.	38.	32.	28.	24.	20.	17.	15.	13.	11.

PLAN 2 SAME AS PLAN 1

8/11

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1000.	0

CAPACITY=	0.	0.	2.	7.	17.	32.	51.	76.	82.	87.
	124.	169.	218.	273.	334.					
ELEVATION=	986.	988.	990.	992.	994.	996.	998.	1000.	1000.	1000.
	1002.	1004.	1006.	1008.	1010.					

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1000.0	35.0	3.2	1.5	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1000.2	3.1	1.5	500.

CREST LENGTH AT OR BELOW	10.	177.	485.	513.	532.	549.	562.

ELEVATION	1000.2	1001.0	1002.0	1003.0	1004.0	1005.0	1005.7

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
20.	.50	980.20	1.00	1000.00	1000.40

WARNING *** TOP OF DAM, BOTTOM OF BREACH, OR LOW-LEVEL OUTLET IS NOT WITHIN RANGE OF GIVEN ELEVATIONS IN STORAGE-ELEVATION DATA

BOTTOM OF RESERVOIR ASSUMED TO BE AT 985.60
STORAGE-ELEVATION DATA WILL BE EXTRAPOLATED ABOVE ELEVATION 1010.00

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

CHANNEL ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0600	.0500	.0600	938.0	960.0	1450.	.02800

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 960.00 50.00 950.00 100.00 940.00 102.00 938.00 107.00 938.00
109.00 940.00 150.00 950.00 200.00 960.00

STORAGE ON D13.73	0.00	.24	.58	1.24	2.30	3.78	5.66	7.94	10.63
	17.23	21.15	25.51	30.32	35.57	41.27	47.42	54.01	61.05
ON D68.54									
OUTFLOW	0.00	32.19	114.49	287.26	590.91	1064.38	1741.57	2653.43	3828.81
..5294.98									
	7077.97	9179.94	11645.04	14514.47	17813.78	21567.81	25800.78	30536.30	35797.48
.41606.89									
STAGE ON 948.42	938.00	939.16	940.32	941.47	942.63	943.79	944.95	946.11	947.26
	948.58	950.74	951.89	953.05	954.21	955.37	956.53	957.68	958.84
ON 960.00									

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1 .05
HYDROGRAPH AT	1	.36	1	53.
		(.93)		(1.49)(
			2	53.
				(1.49)(
ROUTED TO	2	.36	1	1965.
		(.93)		(55.63)(
			2	36.
				(1.02)(
ROUTED TO	3	.36	1	1962.
		(.93)		(55.57)(
			2	36.
				(1.02)(

RATIOS APPLIED TO FLOWS

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ••••••••••••••

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1000.00	1000.00	1000.20
STORAGE	82.	82.	87.
OUTFLOW	0.	0.	10.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.05	1000.40	.20	91.	2003.	2.96	43.19	42.50

PLAN 2 ••••••••••••••

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1000.00	1000.00	1000.20
STORAGE	82.	82.	87.
OUTFLOW	0.	0.	10.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.05	1000.40	.20	91.	36.	8.00	42.50	0.00

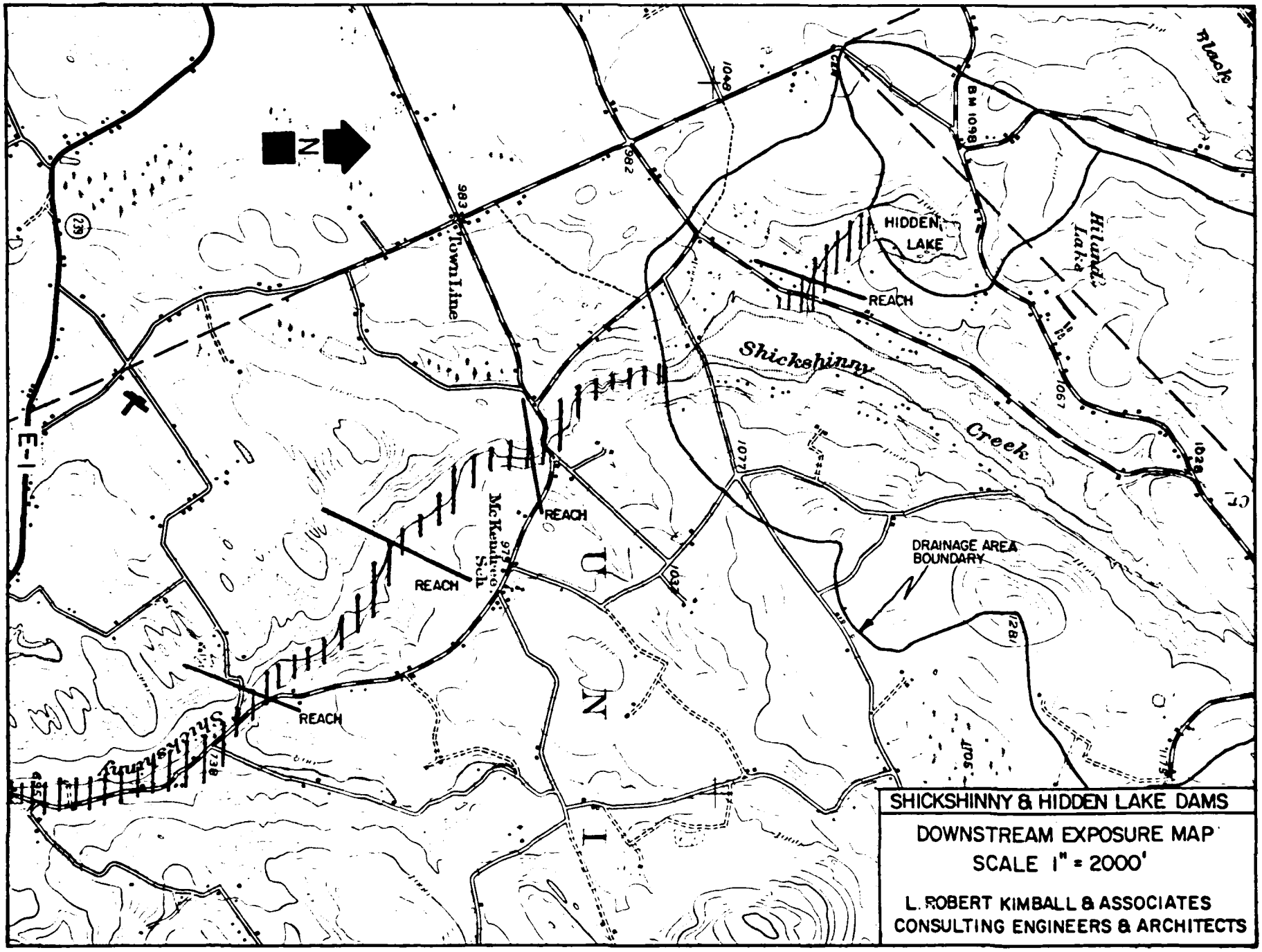
PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.05	1962.	945.2	43.25

PLAN 2 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.05	36.	939.2	42.75

APPENDIX E
DRAWINGS

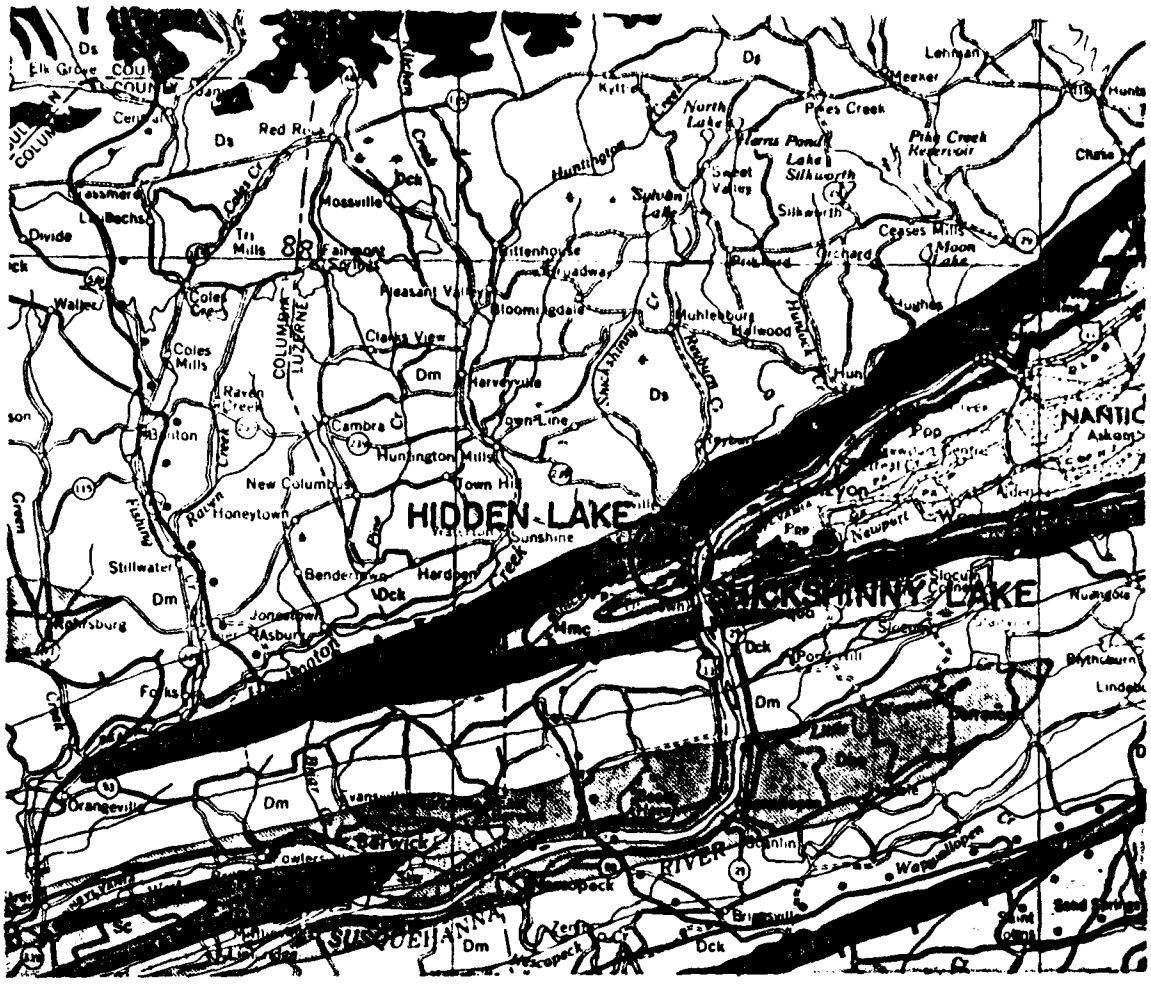

N
Town Line
HIDDEN LAKE
REACH
Shickshinny Creek
Hillard's Lake
Black
BM 1098
DRAINAGE AREA BOUNDARY
REACH
REACH
REACH
McKendrick Sch.
Shickshinny
E-1
SHICKSHINNY & HIDDEN LAKE DAMS
DOWNSTREAM EXPOSURE MAP
SCALE 1" = 2000'
L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS

APPENDIX F
GEOLOGY

General Geology

Hidden Lake Dam lies within the Appalachian Mountain Section of the Valley and Ridge Physiographic Province. This region is characterzied by overturned and assymetric folds, local shearing and large, low-angle thrust faults. The only faulting indicated in the area of the reservoir is about seven or eight miles away, both to the east and to the southwest.

The bedrock underlying the lake and dam is the Mississippian aged Pocono Group. This group consists mainly of sandstone with lesser amounts of conglomerate siltstone, shale and coal. The moderate to thick bedding is normally well developed. The regular and steeply dipping to vertical joints are also well developed. The rocks of the Pocono Group are very resistant to weathering and form an excellent foundation for heavy structures. The interstitial and secondary porosity give the rocks of this group a high effective porosity.



Geologic Map of The Area Around Hidden Lake And Shickshinny Lake

Pocono Group

Predominantly gray, hard, massive, cross-bedded conglomerate and sandstone with some shale, includes in the Appalachian Plateau Burgoon, Shenango, Cuyahoga, Cussewago, Corry, and Knapp Formations, includes part of Oswayo of M.L. Fuller in Potter and Tioga counties

Scale : 1:250,000